SP-E1.1 Statewide Operations Model Development

October 25, 2002

1.0 Introduction/Background

Oroville Reservoir is operated by DWR as part of the State Water Project (SWP) for multiple purposes including:

- SWP water supply;
- Flood Control;
- Recreation;
- Fisheries; and,
- Delta Water Quality.

Oroville Reservoir Operations in the Delta are also coordinated with USBR Central Valley Project Operations through the Coordinated Operating Agreement. Because of this, Oroville Reservoir operations are driven by statewide parameters and changes to Oroville operations may have statewide impacts. In order to simulate Oroville operations and evaluate the impacts of changes to Oroville operations statewide modeling is required. This modeling will serve three distinct purposes:

- Define local water supply operation boundaries for detailed local impact operation modeling
- Serve as base for analysis of any proposed project measures
- Allow verification that re-licensing measures do not have a statewide impact

Statewide modeling is typically done on a monthly timestep for impact analysis purposes where simulations with and without project are performed and the difference used for the impact analysis. In that case the assumption can be made that if the model is not correct the same error exists in both simulations and the differences are still accurate. For this project the statewide modeling will be used to define boundary conditions for detailed analysis of Oroville/Thermalito Operations and impacts. This means that the absolute values from the simulations are extremely important. It also means that these simulations will form a critical base for all following analysis.

2.0 Study Objective

The goal of this study is to use CALSIM II, a statewide SWP/CVP operation simulation model, to perform the benchmark simulations to allow determination of "boundary" conditions for localized modeling and to allow evaluation of statewide impacts of modified Oroville operations.

3.0 Relationship to Relicensing /Need for the Study

The relicensing process requires analysis of potential impacts from a wide range of operational alternatives. The model developed as a result of this study will be used to produce simulated operational data from these alternatives for use in the required analysis.

This study will develop the required tools and baseline studies that will allow analysis of impacts. The initial baseline studies are used to define the pre-project conditions. Additional simulations of alternatives using the statewide operations model can then be used to identify changes in operations and their impacts on other resource areas.

Engineering and Operations Issues Addressed

- E1—evaluate the potential for adding additional generation using existing infrastructure, modifying facilities to increase storage and associated generation, and changing operation to provide spinning reserve (e.g., motoring) (Issues addressed: EE 1, 2, and 14).
- E4—evaluate environmental and economic aspects of different flow regimes of Oroville Facilities operations. Factors to be considered include timing, magnitude and duration of flows, pump-back scheduling and maintenance scheduling, and hatchery operations.
- E6—effect of ramping rates on downstream facilities, power generation, water supply, water temperatures, and fish.
- E7—effect of the project including discharge (magnitude, frequency and timing) and ramping rates and the altered stream hydrology on substrate scour, mobilization of sediments, turbidity levels, and riparian vegetation in the low flow reach and downstream of the Afterbay.
- E10—effect of future water demands on project operations including power generation, lake levels and downstream flows. Consider sale of existing water allotments to downstream users.
- E12—evaluate operational and engineering alternatives including selective withdrawal from Lake Oroville, Thermalito Afterbay, the hatchery, and the low flow section to meet various downstream temperature requirements.
- E14—evaluate operational alternatives that balance and maintain acceptable water quality standards including those for MTBE under all operational plans and conditions.
- E15—evaluate operation alternatives that maintain or improve current water supply under all operation plans and conditions.

4.0 Study Area

The study area includes the major facilities of the USBR Central Valley Project (CVP) and the DWR State Water Project (SWP). These include the Trinity, Sacramento, and San Joaquin river basins as well as the Sacramento – San Joaquin Delta and the Delta Mendota Canal (CVP) and California Aqueduct canal systems.

5.0 General Approach

A generalized model of the SWP/CVP system, CALSIM II, jointly development by USBR and DWR, has recently been released by DWR for evaluation and comments from interested entities. CALSIM II is an enhanced version of the CALSIM model that will replace PROSIM, DWRSIM, and CALSIM as the only approved statewide modeling tool available for both agencies. The model features many updates to the basic hydrology, the surface water- ground water interface, enhancements to joint CVP-SWP operations, and revised b (2) and EWA implementations.

CALSIM II is the preferred tool for the long-term, statewide operations modeling for this project if it is completed and accepted by DWR, USBR, FERC and other parties and agencies involved in this relicensing. The schematic for the CALSIM II model is included as Attachment A.

There is an organized effort currently underway to systematically evaluate, and if required, enhance the released version of the CALSIM II model to be suitable for use in a number of ongoing investigations. The first step in this process will be the release of current and future level "benchmark" studies that are planned for use by a number of ongoing processes such as the USBR OCAP, Coordinated Operation Agreement negotiations, etc. The initial 2001 benchmark study is due for release Dec 7, 2001 with the initial 2020 benchmark study anticipated for release at a later date. DWR is also in the process of creating a 2030 level of development hydrology for use in the CALSIM II model. This hydrology will have the usual land use modifications for accretion/depletion computations in the Sacramento Valley and will also include implementation of land use based hydrology in the San Joaquin Valley and updated rim inflow values based on updated hydrology and operations of the river basins upstream of the CALSIM II schematic. The hydrology is being developed for the Bulletin 160 process and is expected to be completed in April or May of 2002. A 2030 level benchmark study may be completed using this new hydrology.

The statewide modeling for this process will use the CALSIM II model and the initial benchmark studies as the starting point for all statewide modeling activity.

Detailed Methodology and Analysis Procedures

Task 1—Define Desired Outputs from the Model

The CALSIM II model will be used to define the overall water supply based operations of Oroville reservoir. The results of the simulations will be used as boundary conditions for other, more detailed simulations in other models. The major outputs desired are:

- Monthly Oroville Storage Level;
- Monthly Feather River Flow below Thermalito Return;
- SWP/CVP water supply delivery; and,
- Other statewide operation results.

Additional desired outputs may be identified as the study plans from other work groups are completed and the process proceeds.

Task 2—Review Existing Models

The CALSIM II model has been selected as the model to be used for this purpose.

Task 3—Review Existing Data

The CALSIM II model has been selected as the model to be used for this purpose. The model will not be modified for use in this process, therefore there is no work proposed under this task.

Task 4—Review Modeling Tools

The CALSIM II model has been selected as the model to be used for this purpose, therefore there is no work proposed under this task.

Task 5—Select Appropriate Model or Modeling Tool

The CALSIM II model has been selected as the model to be used for this purpose.

Advantages to using CALSIM II include:

- Jointly developed and verified by DWR/USBR the SWP and CVP operators respectively;
- Will be used in numerous other processes such as CALFED;
- Covers desired area;
- Produces required outputs; and,
- Replaces all other known existing models.

Task 6—Collect Field Data for Development/Calibration/Verification

The CALSIM II model has been selected as the model to be used for this purpose, therefore there is no work proposed under this task.

Task 7—Model Development/Calibration/Verification

Even though the CALSIM II model will be fully developed and available for use in this project the model will need to be obtained and installed for use in the process.

Task 7A—Obtain CALSIM II Model and Required Supporting Software

The CALSIM II model is currently available for download from DWR's web site. The most recent version of CALSIM II will be downloaded from the website and installed on a PC.

Running CALSIM II requires purchase and installation of a linear programming solver, XA, and the Lahey FORTRAN 90 compiler. These required software packages will be purchased and installed on the PC with the CALSIM II model.

Task 7B—Verify CALSIM II Installation

Once installed test input/output datasets will be downloaded from the DWR website. The simulations will be performed and the results verified with the outputs from the website to ensure that the model is installed and operating correctly.

Task 8—Integrate Completed Model into Model Development Scheme

This task is to develop the transfer utilities required to extract the desired outputs from the CALSIM II output files, perform any computation on them that may be required and store the results in the central modeling database.

Task 9—Perform Benchmark Simulations

Task 9A—Obtain Initial Benchmark Simulations

The initial benchmark studies (2001, 2020, and possibly 2030 LOD) will be available for download from DWR's web site when they are completed. The input/output data sets will be obtained from DWR, the simulations run with the input data and the results compared to the output data from DWR to verify the model installation and performance.

Task 9B—Develop Modified Assumptions, if Required, for Benchmark Studies for this Process

The assumptions being used in the initial benchmark simulations were developed for use in specific programs such as CALFED. Because this process is different from these programs the assumptions need to be reviewed and possibly modified to ensure that they are appropriate for use in the process. The draft initial assumptions for the benchmark studies are included as Attachment This subtask will require coordination with the other workgroups. Since these assumptions will be used to define the benchmark conditions for all subsequent modeling and analysis it is critical that they be carefully defined. The final assumptions will be approved by the work group.

Task 9C—Perform Benchmark Simulations for this Process

Perform the appropriate benchmark simulations for this process using the assumptions from Subtask 2. If the initial assumptions are not modified then this task will not be required, as Task 1 will have already produced the appropriate simulations.

Task 9D—Integrate Results into Central Modeling Database

Using the utilities developed under Task 8 load the results of the benchmark simulations into the central modeling database for use in impact analysis or further modeling.

6.0 Results and Products/Deliverables

Results

This study plan will result in a statewide operations simulation model and benchmark studies for use in the process.

Products/Deliverables

There will be two products of this study plan:

- A statewide operation model of the CVP/SWP systems that is accepted as the standard model for this type of simulation by both DWR and USBR. This product will be fully integrated into the overall modeling scheme.
- Simulated statewide operations for the benchmark studies for use in other analysis.

7.0 Coordination and Implementation Strategy

Coordination with Other Resource Areas/Studies

This study will require coordination with Study #1—Model Development; Study #1a—Statewide Operations Model Development; Study # 1b—Local Operations Model Development; and Study # 2—Modeling Simulation. This study will be coordinated with various water quality study plans including: SPW1, SPW4, and SPW6. The identification of the appropriate assumptions for benchmark studies will need to be done in coordination with other workgroups and regulatory agencies. The assumptions selected will be approved by the work group.

Issues, Concerns, Comments Tracking and/or Regulatory Compliance Requirements

None

8.0 Study Schedule

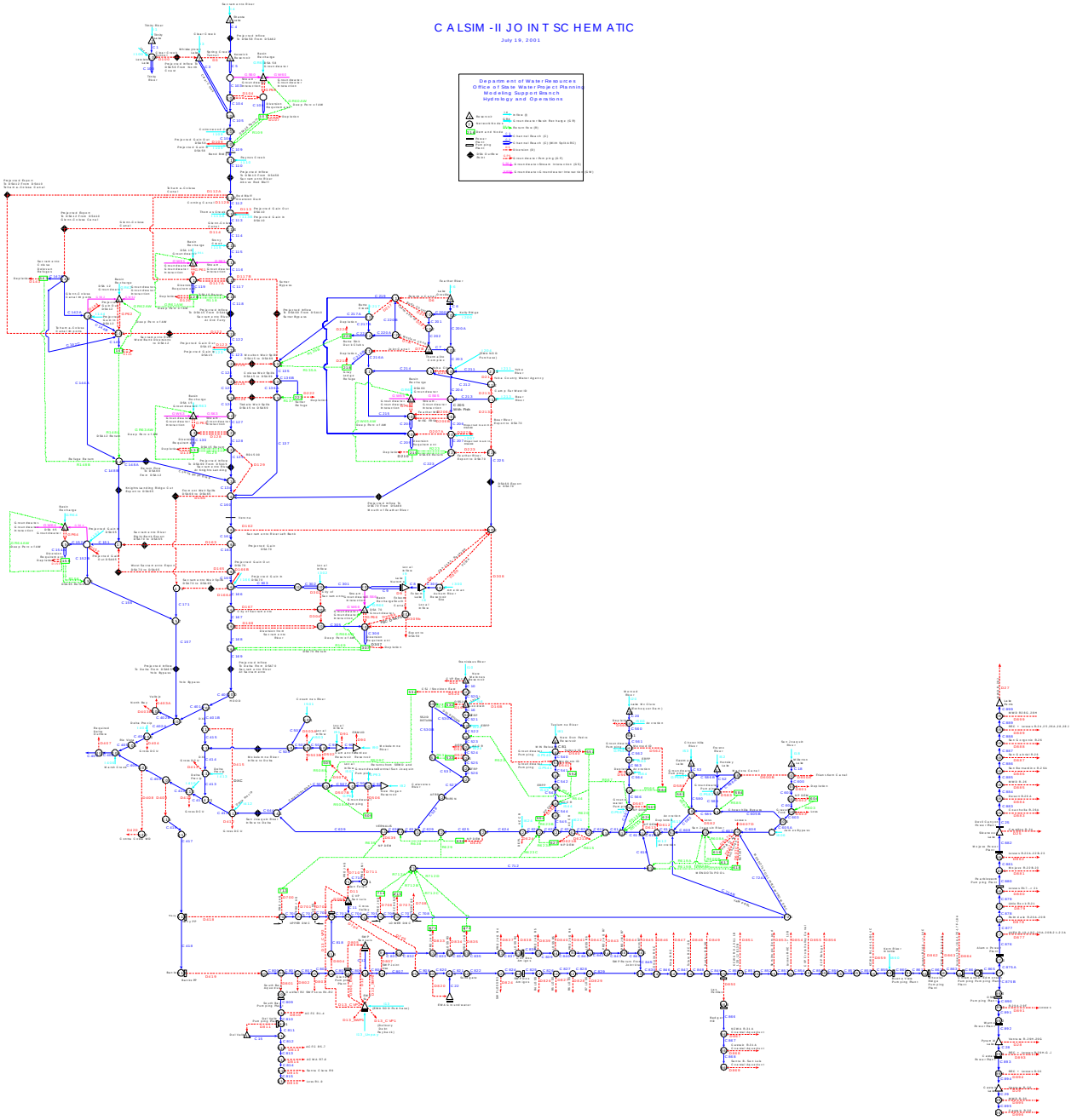
This section to be developed.

9.0 References

CALSIM II Work Plan, Water Management/Allocation Studies, CALFED/DWR/USBR, September 1, 2001.

Draft Benchmark Studies Assumptions, Water Management/Allocation Studies, CALFED/DWR/USBR, September 4, 2001.

Attachment A
CALSIM II Schematic



Attachment B
Draft Benchmark Studies Assumptions